

ABSTRACT

A fluid supply apparatus with a plurality of flow lines branching out from one regulator for adjustment of pressure, the flow lines being arranged in parallel, wherein a measure is taken that the operation, that is, opening or closing of one flow passage will
5 have no transient effect on the steady flow of the other flow passages. For this purpose, each flow passage is provided with a time delay-type mass flow controller MFC so that when one closed fluid passage is opened, the mass flow controller on that flow passage reaches a set flow rate Q_s in a specific delay time Δt from the starting point.

Also provided are a method and an apparatus for the above in which a plurality
10 of gas types can be controlled in flow rate with high precision by one pressure-type flow control system. To that end, a formula for calculating the flow rate of a gas is theoretically derived that flows with a pressure ratio not higher than the critical pressure ratio. From that formula, the flow factor is defined; so that the formula may be applied to a number of gas types using flow factors.

15 The method includes calculating the flow rate Q_c of a gas passing through an orifice according to formula $Q_c = KP_1$ ($K = \text{constant}$) with a pressure P_1 on an upstream side of the orifice set at twice or more higher than pressure P_2 on a downstream side, wherein the flow factor FF for each kind of gas is calculated as follows:

$$FF = (k/\gamma_s) \{2/(\kappa + 1)\}^{1/(\kappa-1)} [\kappa/(\kappa + 1)R]^{1/2}$$

20 and wherein, if the calculated flow rate of gas type A is Q_A , and, when gas type B is allowed to flow through the same orifice under the same pressure on the upstream side and at the same temperature on the upstream side, the flow rate Q_B is calculated as follows:

$$Q_B = (FF_B/FF_A)Q_A$$

where

γ_s = concentration of gas in standard state;

κ = ratio of specific heat of gas;

R = constant of gas;

5 K = proportional constant not depending on the type of gas;

FF_A = flow factor of gas type A; and

FF_B = flow factor of gas type B.